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By

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This study evaluates the impact of Thailand's Million Baht Village Fund program on household fertility decisions. Thailand's fertility rates are alarmingly low and it is imperative to recognize the unintended consequences a microfinance program may have on fertility choices within Thailand. Using panel data from pre- and post-program years, this research identifies the change in number of babies in a household associated with getting a microloan from the Village Fund program. The quasi-experimental nature of the program and an instrumental variable model with fixed effects identifies a negative relationship between the number of babies within families and participation in the microfinance program. Although the impact is statistically significant, the decrease in babies due to participation is not of practical significance.

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1 Introduction

Microfinance programs are an important part of financial intermediation in developing countries. They help connect potential borrowers with small loans, especially in poor and rural areas. This research focuses on a government-funded microfinance program in Thailand. This program, Thailand's Million Baht Village Fund, has a few qualities that give it a degree of exogeneity where most microfinance programs are endogenous and makes measuring the impacts of the funds difficult.

All Thai villages were eligible for the microfinance program and had to submit an application and form a village committee to be accepted. The program introduced funds into 77,000 diverse Thai villages accepted into the program. Each village received a transfer of one million baht (about $25,000),[1] which was used to provide village members with small loans.

One aspect of the program that gave it a degree of exogeneity was its surprise onset after a quick dissolution of one political party and the rise to power of another. The second is the uniform amount distributed to each village. I will discuss these two elements in more depth in Section 3.2.

To clearly understand if a microfinance program is a useful and efficient utilization of development funds, it is crucial to understand how these injections of credit are impacting the households, villages and larger economies exposed to them. Development economists are often focused on concrete and obvious determinants of a country's development. There is a plethora of research on how different development

[1] During this time period, the exchange rate between dollars and baht was roughly 40 baht to 1 US dollar.

policies and tools impact GDP, income per capita, and household consumption. These studies answer the question of how development tools, like a microfinance program, impact financial factors of development, but overlook the importance of other key features of a developed country.

Fertility rates are one such determinant of development. It is widely accepted that as countries develop, fertility rates drop. My research looks at the impact of The Million Baht Village Fund, on fertility in Thailand. While many less developed countries have high fertility rates, Thailand is experiencing abnormally low fertility rates. With a fertility rate below the replacement rate,[2] this means the Thai people are not having enough babies each year to maintain their population levels. This might not seem like an immediate problem, but prolonged years with a fertility rate below replacement rate (2.1 births per woman) can results in serious labor shortages and adverse economic consequences.

Little research exists on the impacts of microfinance programs on fertility (Kuchler 2012; Banjeree et al. 2015). My findings could help guide efficient development policy decisions in Thailand and other developing countries. The sign and significance of the impact of a microfinance program on fertility is important in Thailand. If the unintended consequences of a microfinance program have a negative and significant influence on fertility in a country with existing low fertility rates, then a microfinance program needs further consideration before it is implemented. By using 11

[2] The replacement rate is generally accepted to be roughly 2.1 births per woman and Thailand's fertility rate was 1.5 births per woman in 2014 (http://data.worldbank.org).

years of panel data along with a combination of an instrumental variable and fixed effects, I hope to add to the existing literature.

My results show getting a microloan does decrease the number of children a household has, but the amount by which it decreases is insignificant in practical terms. A country should be aware that a microfinance program could cause decreases in fertility rates, but unless the influx of funds is massive, the decrease will not be substantial. The policy implications of these findings suggest that to avoid decreases in fertility a microfinance program should be accompanied by other policies that combat decreased fertility. In the case of Thailand, the other benefits of microfinance easily outweigh the small and insignificant cost.

2 Literature Review

2.1 Microfinance

In the past 25 years, micro lending has become one of the most significant development policy tools. Lack of access to credit is arguably one of the main reasons people in developing countries have difficulty escaping poverty. Studies have shown that access to credit can increase productivity and quality of life in lower-income households (Khandker 1998). Without a loan from a formal or informal institution, many people find it impossible to save the funds to start or expand a business or get an education, which may raise their chances of climbing out of poverty. Whether they want to invest in a business opportunity or increase the potential of their own human capital, these endeavors can require a substantial amount of initial funds. Gathering initial funds is a barrier to people who don't have access to financial institutions. Poorer people in

developing countries typically have less access to loans because they do not have the necessary collateral to put up for a loan from a bank. Another problem facing a poor individual is that the bank's cost of monitoring and screening a poor borrower is too high for it to be a profitable loan for the bank (Hermes and Lensink 2007).

Microfinance programs are a useful way to inject funds into the local economies of developing countries. KIVA, which means "unity" in Swahili, is a non-profit organization based out of San Francisco that exemplifies the microfinance ideology of a "hand up instead of a handout." The organization collects short biographies on individuals or groups from around the world who are looking for a microloan. People donate to KIVA and choose which group or person receives their funds. An example is Lila, a 43-year-old from Alipurduar, India, who needs $475 to help her buy a cow so she can produce milk, butter and other products to sell. At some point the borrower repays the money and the donor picks another person to whom to lend. The program started in 2005 and so far has spread to 82 countries and lent out $938.3 million with a 97 percent repayment rate.[3] Their goal is to help one person in a community, for example, start a business, which will have a ripple effect of positive impacts on other people in that community.

Numerous models exist for microfinance programs. One of the most prevalent models is group-based lending. The Grameen Bank, in Bangladesh, has a system where five people form a group and each receives a loan. If one member of the group defaults on their personal loan, the whole group will no longer be eligible for loans (Khandker and Pitt 1998). The Thai Village Fund program operates similarly. Funds are given to a

[3] www.kiva.org

village committee that then lends money to village members. Receiving funds for the credit program in subsequent years is dependent on the village's successful repayment of the members' loans (Kaboski and Townsend 2011). Group-based credit programs incentivize people to monitor and assist other members in the group instead of using collateral as most bank loan models do. Group-based lending is especially useful for poor households that would not have collateral to get a loan (Khandker and Pitt 1998).

Although KIVA and other programs boast the positive impacts of microloans, there is a substantial amount of research about whether micro lending is an effective development tool. Gaonkar and Henriques (2011) find that poor people are more likely to use a micro loan for productive and income-generating activities than wealthier individuals. This evidence suggests that micro lending is a positive development tool. However, there is controversy over the effectiveness of microloans. Ahlin and Jiang (2008) state the theoretical framework for microfinance success hinges on the rate at which self-employed microfinance participants "graduate" from small-scale operations to full-scale. They find that although loans do tend to lower inequality and poverty, in the long run, they can either raise or lower GDP.

A wide area of study looks at microloans given to low–income households. Evidence from Bangladesh suggests that access to microloans have substantial positive effects for the poorest people (Khandker 2005). Using data from 1991/92 and 1998/99 in Bangladesh, Khandker (2005) finds microfinance accounts for about half of the 3-percentage-point annual reduction in poverty among program participants. Studies of government microfinance programs in Thailand show the effects of a microloan program on expenditure and incomes are quite large for low-income households. Most borrowers

were poor and from the agricultural sector (Boonperm et al. 2013). These results support the idea that microfinance programs successfully target the poor. Looking at two years of panel data of rural households from the Thailand Socioeconomic Survey, Boonperm et al. (2013) used a fixed-effects model and found borrowing from the Million Baht Village Fund is associated with a 3.5 percent increase in current spending and 1.4 percent more income. Using nationwide data from 2004, Boonperm et al. (2013) found similar results using a propensity score matching model and additionally found that Village Fund loans are associated with purchasing of more durable goods.

The real effects of microloans are unclear. Evaluating the impacts of a microfinance program started in 2006 in Morocco, researchers find that microcredit is a valuable financial instrument for the poor, but self-employment investments do not result in an exit from poverty within two years of receiving the loan (Crepon et al. 2015). Similarly, a randomized control trial in Ethiopia between 2003 and 2006 found that three years after the implementation of a microfinance program the fraction of households with loans increased 25 percentage points when compared to control areas (Desai et al. 2015). Despite this significant increase in the number of households receiving loans, there was no clear evidence of widespread improvement in socioeconomic indicators, such as income-generating activities, livestock ownership or schooling. The influx in borrowing was not associated with more non-farm business creation.

Most of the current studies of microfinance programs focus on the impacts the programs have on economic outcomes like income, consumption and GDP (Ahlin and Jiang 2008; Banerjee et al. 2015; Boonperm et al. 2013). To decide if microfinance programs are effective development tools, it is important to look at other dimensions of

development, like subjective well-being, empowerment and fertility. This research will focus on fertility.

2.2 Fertility and Development

Fertility rates are seen as a key indicator for a country's development level. As a country develops, its fertility rates tend to decrease. Several factors of development can impact fertility and result in this negative correlation between development and fertility rates. More developed countries compared to less developed ones have better and more access to health care. More accessible health care lowers infant mortality rates (Gruber et al. 2014). If a family expects more of their children to survive, they might have fewer children, lowering fertility rates in a country.

Another possibility is that a developing country moves away from agricultural economies to a more industrialized economy. This can affect fertility in two ways. One being the availability of industry jobs might increase the opportunity costs of staying at home and bearing children. The other way is that families that focus on agricultural work might choose to have more children so they have more help on the farm. If they move away from agriculture, they might have fewer children because they do not need as much help with labor in the home. Cross-sectional evidence from Egypt supports this hypothesis by looking at a farmer's land share of specific crops and resulting fertility changes (Levy 1985). Cotton is a crop that has a high demand for child labor, and Levy (1985) finds a 10 percent increase in cotton's land share results in a 1.5 percent increase

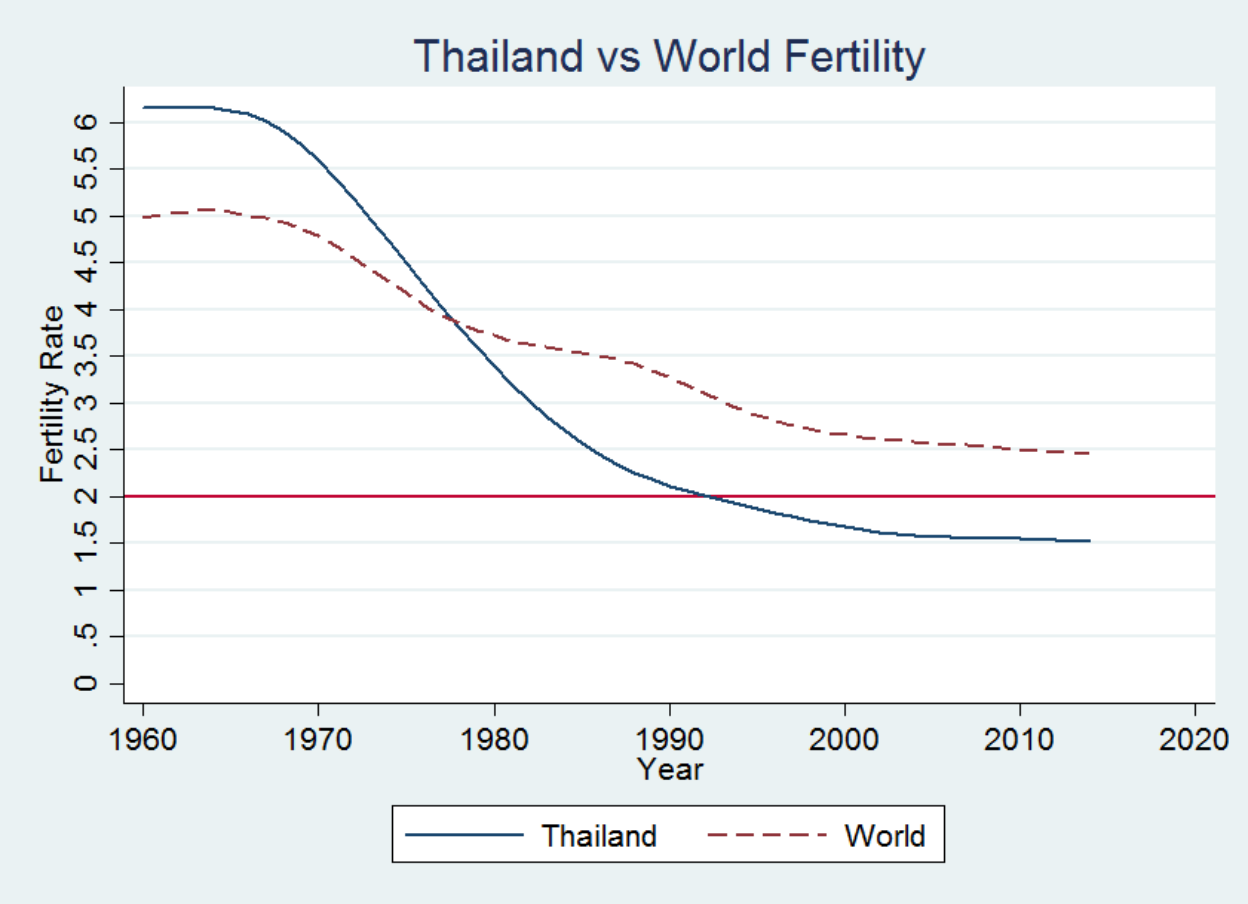
in fertility. These findings suggest that the usefulness of children as laborers directly influences a farming household's fertility decisions.

As a country develops, its populace might decide to invest in their human capital by getting an education. If a woman has to choose between going to school and having a child, she might decide to delay childbearing. With the assumption that lower infant mortality rates, industrialization, and increased education are all characteristics of a developing country, I have shown how fertility can also be viewed as an indicator for a country's development. This suggests that developing countries might have a goal of lower fertility rates. But, issues can arise if a country's fertility rates drop too low.

2.3 Fertility in Thailand

In the early 1960s, Thailand reached a total fertility rate of about 6.5 births per woman. High fertility was encouraged by government policy, which provided incentives for early marriage and bonuses for large families (Mithranon and Prachuabmoh 2003). Around the same time, governments and policy planners became concerned with the consequences rapid population growth due to high fertility would have on economic development. As a result, the Thai government formulated strategies to combat these fears. By the 1970s, government concerns about high population growth resulted in the implementation of an official population policy and the National Family Planning Program, which provided contraception and other services, aimed at lowering fertility and population growth.

Figure 1



Fertility declined steadily. According to the World Bank,[4] by 2010, total fertility rates in Thailand had dropped to about 1.5 births per woman, with slight variation among the regions within Thailand. This fertility rate is below the replacement level, which is generally accepted to be about 2.1 children per woman. Thailand's decline in fertility rates is one of the quickest among newly industrializing Asian economies (Mithranon and Prachuabmoh 2003). With such a low fertility rate, Thailand faces new challenges and concerns regarding population policy, such as an aging population and impending labor shortages.

[4] http://data.worldbank.org/

2.4 Microfinance Programs and Fertility

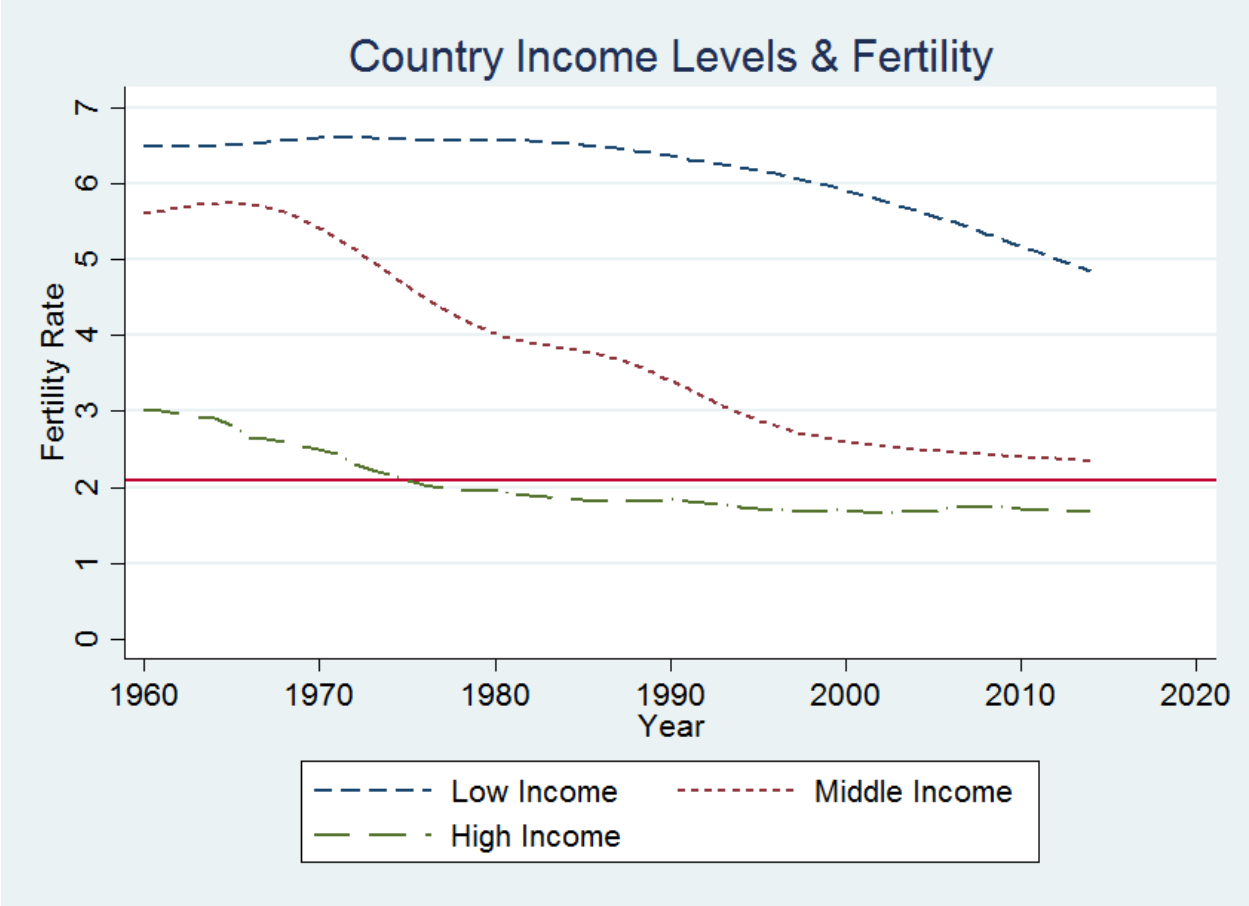
With low fertility issues, it is important to understand how a microfinance program might affect the number of children a household decides to have. The key behind how this microfinance program will impact fertility is whether children are normal or inferior goods.[5] As income increases, consumption of normal goods increases. The amount consumed of an inferior good decreases as income increases. So, if household income increases and the household consequently has more children, then children are a normal good.

An increase in credit increases the value of a woman's time. Increased value of time can result in positive or negative changes in the demand for children. The income effect applies when the increase in income causes an increase in demand for children, assuming the cost of having children remains constant. On the other hand, the increased value of a woman's time increases the opportunity cost of having a child and results in the substitution effect (Pitt 1999).

Research shows that, generally, there is a negative correlation between income and family size (Lindo 2010). These findings suggest that children are inferior goods and that as households make more money they substitute away from having children. Figure 2 supports this idea by showing women in higher-income countries have fewer children.

[5] I am using specific economic language when referring to children as normal or inferior goods and observing how the number of children changes with an income shock.

Figure 2



These results are inconsistent with the assumption of consumer choice theory models, which suggest children are normal goods because as households make more money they can afford the costs associated with more children (Lindo 2010). There are deeper underlying issues aside from solely the costs associated with having children that make this consumer choice theory model a poor representation of child-bearing decisions. For example, as income level rises, people may become more concerned with the quality rather than quantity of children.

Developed countries, which usually have higher income levels, tend to have a lower fertility rate than developing countries (Figure 2), suggesting that fertility reduction

might be a desired goal for development policies, such as a microfinance program (Kuchler 2012). There are several ways a microfinance program could impact fertility decisions.

One example is increasing the opportunity costs for women to have children. The economic theory of fertility suggests if you increase access to credit, you increase opportunities for women and therefore their time becomes more valuable (Kuchler 2012). When a woman has access to credit and can get a loan to start a new business or invest in something, with every child she decides to have, she is forgoing the potential job opportunities. Forgone opportunities increase the opportunity costs of having children and theoretically should decrease fertility as women choose to pursue other options. This inverse relationship between opportunity costs and demand for children is seen in several studies of the relationship between education and fertility (Long and Osili 2008; Kim 2010). Long and Osili (2008) find that using grant funds to increase a female's education by one year reduces the fertility rates of young women in Nigeria by raising the opportunity costs of child bearing for young women. Kim (2010) points out that this inverse relationship between education and fertility could be due to the fact that women with higher educations have a better ability to adapt quickly to new contraceptive technology. There is a link between education and ability to utilize new contraceptive technology. Nevertheless, it is doubtful that an added year of high school-level education could cause the impacts Long and Osili (2008) found in Nigeria if increased opportunity costs are not also responsible for the change.

Pitt (1999) suggests a model of demand for children with the presence of microfinance programs. His theory states that the degree to which the demand for

children is influenced by microfinance participation is directly dependent on the type of self-employment opportunities available. If there are opportunities that are not labor intensive and allow women to work at or near home, then the income effect is likely to be dominant and demand for children would increase. But, if child-bearing and self-employment opportunities are not compatible, then the substitution effect would dominate and people would decide to work instead of having more children (Pitt 1999). In Bangladesh, Pitt found fertility increases with the degree of female participation, but fertility fell with male participation in microfinance programs. His explanation for these results is that the women were able to work in the home or near the home and the income effect was dominant. Pitt suggests fertility fell with male participation due to social development programs, including encouragement within the Grameen Bank to keep families small (Pitt 1999).

Amin et al. (1995) studied three microfinance programs in Bangladesh, including the Grameen Bank, and found alternative results. Using a 1992 national household sample, the researchers found that poor female recipients of microloans who were engaged in income-generating activities experienced a decreased level of fertility, decrease in desire for more children and increase in contraceptive use. Although, these results show a decrease in fertility, it supports Pitt's (1999) idea that the opportunities available to a woman are going to determine the change in fertility.

Lindo (2010) found supporting results with panel data from the United States using a logit model and a linear probability model. The results show that a family reacts to an income shock, in the form of a husband's job loss, by having more children in the timeframe immediately after the shock. There are two possible explanations for this. In a

dynamic fertility model, credit-constrained households have an incentive to delay having a child until the husband earns more. When they lose their job, and the earnings trajectory is significantly reduced, households have less of an incentive to delay having children (Lindo 2010). Another explanation is that a husband losing his job might be seen as a convenient opportunity to have a child because they have more free time to allocate to the task of raising a child (Lindo 2010). This supports Pitt's findings of the relationship between male participation and fertility.

Thailand is a unique case. Women in Thailand are significantly more involved in major decision making and controlling household assets and finances than women in other developing countries. They also seem to have higher ambitions for career advancement (Mithranon and Prachuabmoh 2003). The unusual paradigm in Thailand, might suggest that women in Thailand are exceptionally vulnerable to the increases in opportunity costs due to a microfinance program. But, as Pitt (1999) suggested, if the informal economy is large in Thailand, it is possible the income effect will take over and women will choose to have more children.

2.5 Contribution to Existing Literature

The current research has some weaknesses where my study uses a longer panel and a different method that might offer more reliable results. Kuchler (2012) argues that his research is one of the first to utilize a panel dataset to look at this question and uses two years of panel data. Similarly, Boonperm et al. (2013) uses two years of panel data to study how microfinance programs change income and spending in Thailand. Panel data helps overcome the self-selection biases that plague nearly all microfinance

programs. This self-selection bias stems from the nature of microfinance programs. People choose to take out a loan rather than getting randomly assigned to a loan. Self-selection creates a bias because there might be certain characteristics about a person that makes them more likely to participate in a microfinance program and it is possible those characteristics could also impact key variables. Panel data sets allow researchers to employ useful econometric tools, like difference-in-differences and fixed effects to remove or reduce the bias (Tedeschi 2008). By using 11 years of panel data, my study of Thailand may be able to report impacts that Kuchler's (2012) study in Bangladesh and Boonperm et al. (2013) missed with more limited data. Another weakness of the data used by Boonperm et al. (2013) is the absence of pre-program data. To fully understand the impacts of the program, it is beneficial to have information before and after the implementation of the microfinance program. This allows you to use the pre-program years as a base and compare them with the post-program years to identify the impacts of the program. The data I am using covers five years before the program and six years after the program.

Kuchler's (2012) study uses an eligibility requirement within the microfinance program that allows participation only from those who own less than 1/2 acre of land. Kuchler argues that a comparison among villages that did and did not participate could cause differences in results because of non-random program placement. For example, a microfinance program might be more likely in poor or rural communities. A fixed effects and difference-in-difference model compares the differences between eligible households (less than ½ acre of land) and ineligible households (more than ½ acre of land) with the differences between eligible and ineligible households in nonparticipating villages. He

finds that access to a microfinance programs does not have a significant impact on fertility, but finds fertility decreases with degree of participation, which could point to impacts in the long run (Kuchler 2012).

Kuchler (2012) cites two working papers that outline an important distinction in microfinance literature. Many microfinance programs include contraceptive knowledge and dispersion. Borrowers from the Grameen Bank have to recite the "sixteen decisions" at every meeting; one being "we shall plan to keep our family small" (Kuchler 2012). Buttenheim (2006) studies the relationship between microfinance programs and contraceptive use. The study in Indonesia finds higher contraceptive use in areas exposed to microfinance, but actually borrowing from the program does not have an impact. In a related study, Sukontamarn (2006) finds the presence of the Grameen Bank in the village of the observed individual is associated with lower fertility and lower desired number of children. These results suggest that there is an important distinction between access to a microfinance program and participation in the program.

The scope of the Thai Million Baht Village Fund and the strength of an instrumental variable will allow me to fill a gap in the literature and possibly find results different from Kuchler's (2012) findings. Lindo (2010) found that the best way to understand the causal impact of a family's income on fertility would be to create an experiment where a household is randomly assigned to an income level. In the absence of such experiments, the next best alternative is to find something that randomly adds or takes away from a household's income. The sudden implementation of the Village Fund and its quasi-experimental nature allows me to look at it as an income shock.

3 Thailand

Thailand is a country located in Southeast Asia. Formerly known as Siam until 1939, Thailand is the only country in Southeast Asia to never be colonized by a European power. Its total area is roughly 198,000 square miles and has a population around 68 million people. [6]

Figure 3

[6] Information about the history and economy of Thailand taken from the CIA World Factbook (https://www.cia.gov)

Thailand's main industries include tourism, textiles and agriculture. Thirty-two percent of the labor force's occupation is agricultural. Thailand is currently experiencing a labor shortage and has the fourth lowest unemployment rate in the world at 0.9 percent. This may amplify the importance of identifying the impacts of increased microfinance on fertility rates, because decreases in fertility rates will contribute to exacerbating Thailand's labor shortage.

Thailand is controlled by a constitutional monarchy. In November 2000, the Thai Parliament was dissolved and by January 2001 the new Prime Minister, Thaksin Shinawatra, was in control (Kaboski and Townsend 2012). While running for Prime Minister, Thaksin Shinawatra promised government programs aimed at helping the people of Thailand. Some of the programs he planned to implement were affordable health care, a microfinance program and a debt moratorium for farmers. Many Thai people did not believe these programs would come to fruition, and surprised the Thai citizen when it was actually implemented. The rapid arrival of the program contributed to the unexpected nature of the microfinance program and gave it a quasi-experimental quality because people did not have time to alter their decisions in anticipation of these programs. Shortly after Thaksin's election, the microfinance program was started and the funds were distributed to the villages between 2001 and 2002.

3.1 Million Baht Village Fund

In 2001, Thailand implemented a microfinance program that provided funds to every village to create community-level lending organizations. The goal of the program was to create a way for communities to have a self-sustaining fund that would aid in

occupational development and income-generating activities. This program, Thailand's Million Baht Village Fund, is among the largest microfinance programs in the world. The program distributed approximately $1.8 billion in initial funds, about 1.5 percent of Thailand's GDP for 2001. This influx of funds was distributed to 77,000 Thai villages; each received roughly $25,000 (Kaboski and Townsend 2012). Two features of the Million Baht Village Fund gave the influx of funds a degree of exogeniety.

One of the key features of the Thai Village Fund is the surprise onset. People did not have time to alter their decision-making in anticipation of the program; therefore, we can assume that we can capture the impacts of the Village Fund after its implementation. An example of how this works is that if the population of a country anticipates a huge influx of credit in the next few years, they may alter their decisions leading up to the programs implementation. Altered decision-making before the official introduction of the program would make it difficult to identify the true impacts of the program because the impacts would not be seen when comparing pre-program and post-program years. Additionally, a comparison of before and after people knew about it would be necessary. The second is the wide variation in the concentration of credit injection among villages because each village received the same amount regardless of village size. Smaller villages had relatively stronger injections of credit than larger villages. Variation in relative injection strength acts as a natural way to identify the amount of credit received in each village.

To receive the funds, villages had to form committees and submit applications. Committee members were selected democratically with some regulations in place for fairness. The regulations required that 75 percent of village members be present at the

meeting to select committee members, half of the members had to be women, and members must be over 20 years old and have lived in the village for at least two years. They could not be bankrupt or previously imprisoned, and each member could only serve on the committee for two years (Kaboski and Townsend 2012).

The funds were given to the villages with a few ultimatums. The government told villages that if they mismanaged the funds or the village institutions failed, they would not be given any more funds and other sources of government funding would be cut off. Villages that did particularly well were promised additional funds. In 2005, funds with the highest rating were granted an additional 100,000 baht ($2,500 US) (De La Huerta Barradas 2011).

The villages received sample Village Fund regulations, which gave them idea of how to structure their lending program. While some villages decided to use the sample structure, other villages misunderstood this to be a requirement, which resulted in many of the funds being very similar. The fund usually allotted 900,000 baht ($22,500 US) for regular lending and set aside 100,000 baht ($2,500 US) for emergency lending (Kaboski and Townsend 2012). Loans could not exceed 20,000 baht ($500 US) without special approval from all members of the fund. The repayment period for the loan could not be longer than 12 months, with the emergency loans typically being shorter. They had to charge a positive interest rate, but the Village Fund committee could set a standard rate, on average 7 percent (Kaboski and Townsend 2012).

3.2 Kaboski and Townsend

Kaboski and Townsend (2012) used panel data to determine how the Thai micro-finance program affected consumption in local villages. Their research supported the buffer stock savings model, which suggests that people save more, in the form of liquid assets, in credit-constrained environments. They found that when credit constraints were alleviated, consumption increased. Consumption specifically increased for household and automotive repairs, meat and alcohol. Kaboski and Townsend (2011) use a structural evaluation of the Thai Million Baht Village Fund and found similar results to their 2012 study. Although their research was thorough and evaluated impacts of credit on most aspects of a village economy, they did not look at how it changed fertility in the villages.

Because each village in the Thai Million Baht Village Fund received the same amount of funds from the program, smaller villages received a proportionally larger injection of funds. Following Kaboski and Townsend (2012), using the inverse of village population will provide me with a source of exogenous variation in access to credit. The rapid implementation of the program meant that people did not know that the funds were going to be available to them. This allows me to look at the loans as a sort of income shock. Since there are factors within a household that are likely to influence both fertility and income, this income shock via increased access to credit provided a degree of exogeneity (Lindo 2010). The gaps in methodology within the literature on microfinance programs and fertility along with a lack of analysis in Thailand create an opening for my research to extend Kaboski and Townsend's (2012) research to fertility.

4 Data

The Thai Townsend dataset includes panel survey data of households, institutions and village leaders in Thailand. Robert Townsend created this dataset to find a way to track how households and individuals overcome financial challenges.[7] My research will focus on the household surveys from 1997-2007 and will also use parts of the survey of village leaders. The unit of observation is the household. The dataset contains information at the individual level, but each individual is recorded under a household ID. Because of the way some of the variables were collected, it is necessary to look at the variables at the household level rather than the individual level. The household level is also essential because the individual level data does not specify fertility information and without knowing what children belong to which individual I have to look at the number of children in a household. There is usually a single head in a household, but it is common for there to be non-nuclear households. It is impossible to accurately identify who is a parent to whom.

[7] https://mitpress.mit.edu/blog/townsend-thai-project

Figure 4[8]

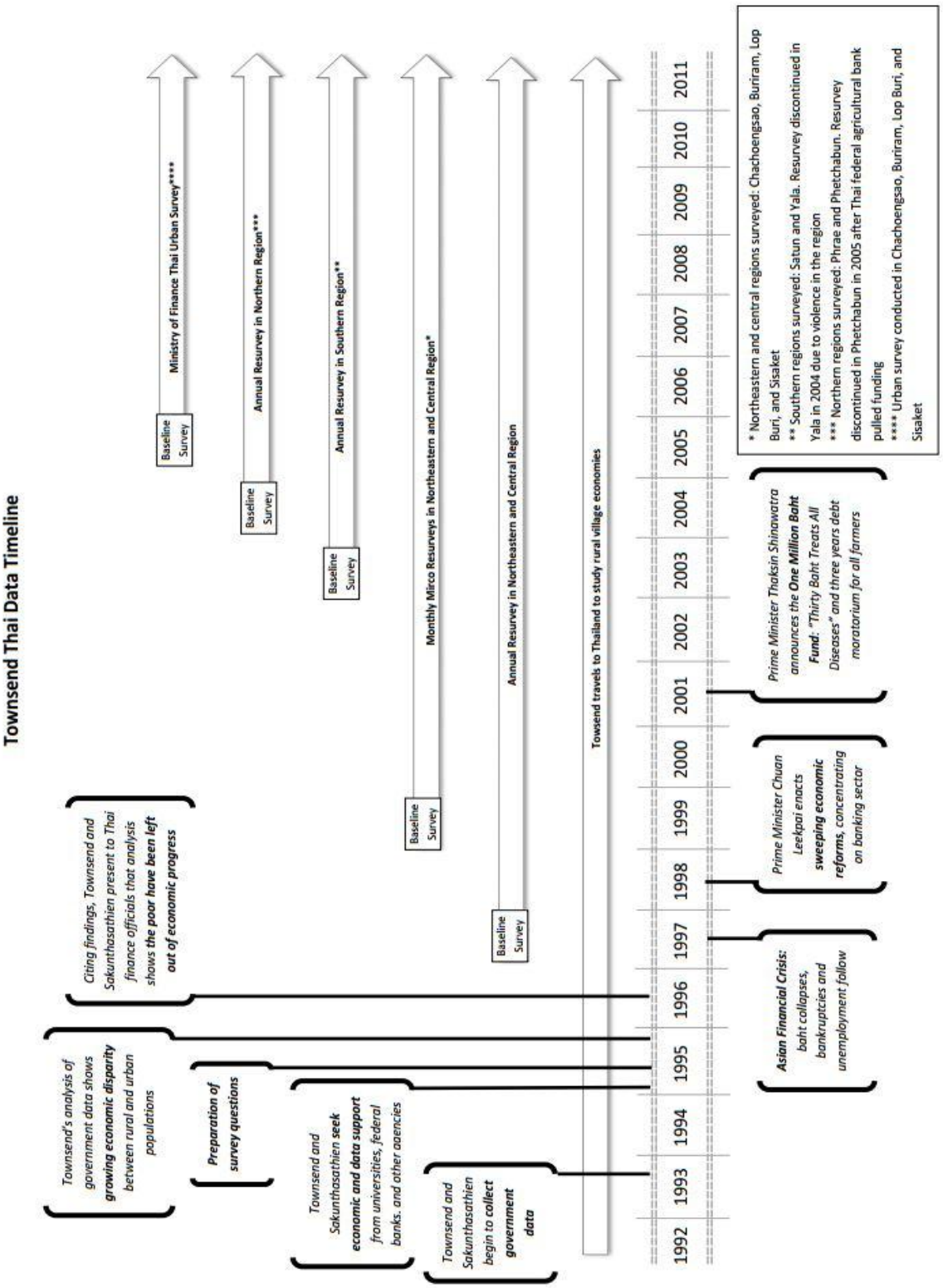
Because Thailand is a diverse country with wide dissimilarities between urban and rural areas, surveyors chose two separate regions to use: one relatively urban region near Bangkok in central Thailand, and another poorer, less developed region in the Northeast. They chose two changwats, or provinces, from each region: Lop Buri and Chachoengsao were chosen from the Central region, and Sisaket and Buriram from the Northeast. These specific changwats were chosen because each had a county that was

[8] https://www.cia.gov/library/publications/the-world-factbook/geos/th.html

also part of the Thai Household Socio-Economic Survey, an annual survey that could be used as a comparison. Twelve tambons, or sub-counties, in each changwat were randomly selected using Geographic Information Systems. Four villages from each tambon were randomly selected. There are 192 villages in the baseline survey. To perform the surveys, enumerators were hired from Thai universities. The baseline survey was the largest and included information from 2,880 households and 192 key informants (village leaders).[9]

[9] http://townsend-thai.mit.edu/

Figure 5 [10]

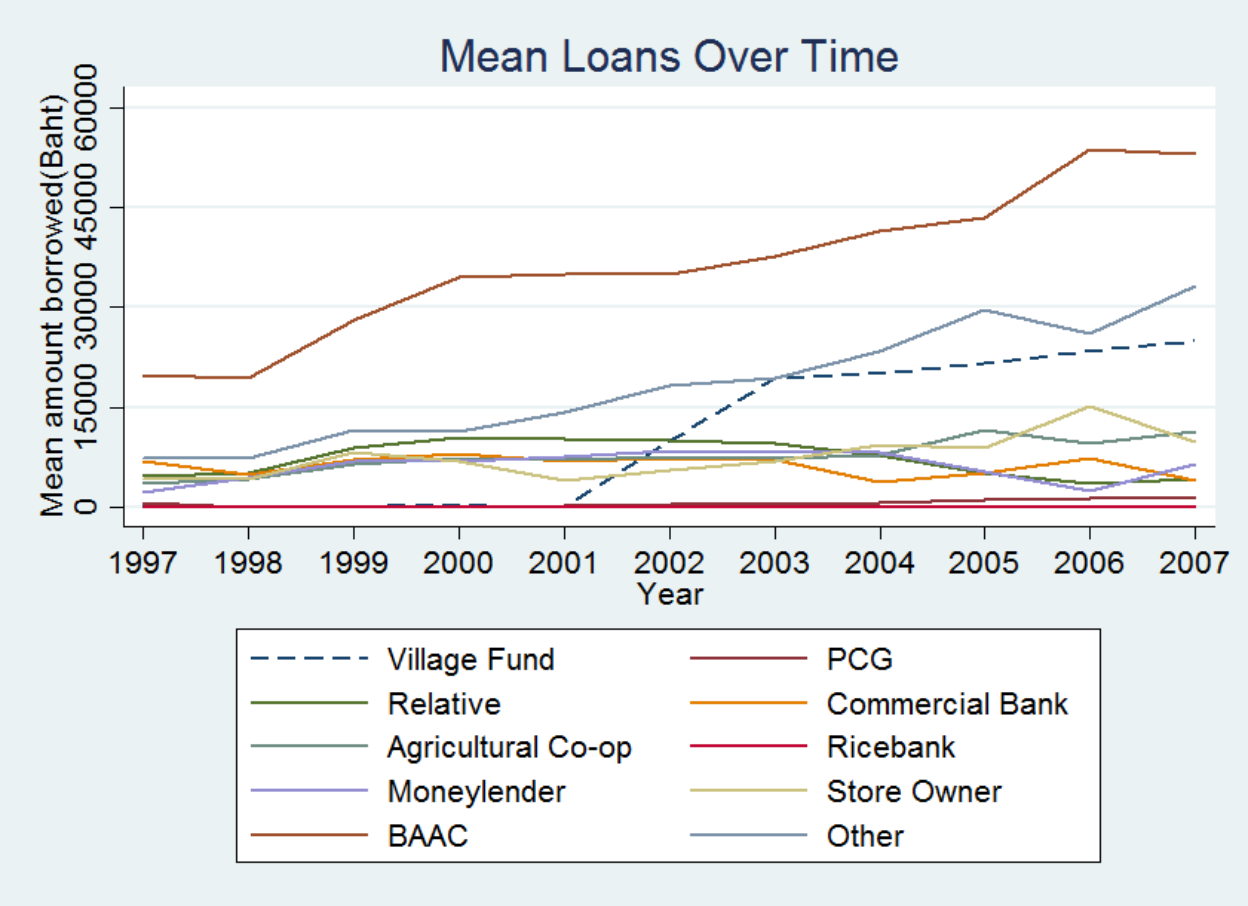


[10] http://townsend-thai.mit.edu/data/Timeline06252012.pdf

The baseline survey was conducted in May 1997, right before the devaluation of the Thai baht in July 1997 and the Asian Financial Crisis. The Townsend Thai Project saw the Asian Financial Crisis as an opportunity to follow the impact of this economic turmoil on households and institutions. In 1998, they randomly chose four of the 12 tambons to resurvey and one-third of the original participants to resurvey. The attrition rate from year to year was about two percent (Kaboski and Townsend 2012) so, of the 960 households surveyed annually, 730 were included in the data I am using for all 11 years (1997-2007). In any panel survey, attrition is an important issue to be aware of. Results can change if certain types of households are leaving the survey. If the leaving households are randomly selected, it would not be an issue. But, it is possible that there are certain qualities and characteristics that make a household more likely than others to leave the annual survey. For the purpose of this research I assume that the households that left the survey were random. For further research, it would be useful to identify any similarities between households that left the survey.

This panel dataset has many strengths, including the detail of the survey and the time period it spans. Along with taking place during a time of economic change, the data also catches the impacts of the 2001 Thai Million Baht Village Fund, which sent an influx of credit into village economies.

Figure 6



As seen in Figure 6, the average amount borrowed from the Village Fund increases drastically after the program's implementation in 2001, and continues to gradually increase in the years after. Table 1 shows that along with more money being borrowed from the Village Fund, more households are borrowing from that source. In 2001, eight households had a loan from the village fund. By 2002, 448 households had a Village Fund loan. This sharp influx of cash further supports the quasi-experimental nature of the Thai Million Baht Village Fund due to its rapid onset. After 2001, Figure 7 indicates that households started to get more loans. The number of households with zero to two loans decreased and the number of households with more than two loans

increased. Figure 6 shows that although the Village Fund is not the main source of loans, it makes up a significant proportion of the money borrowed in Thailand. This combined with the visible impacts of the Village Fund in Table 1 and Figure 7 suggests it should have significant impacts in my analysis.

Table 1

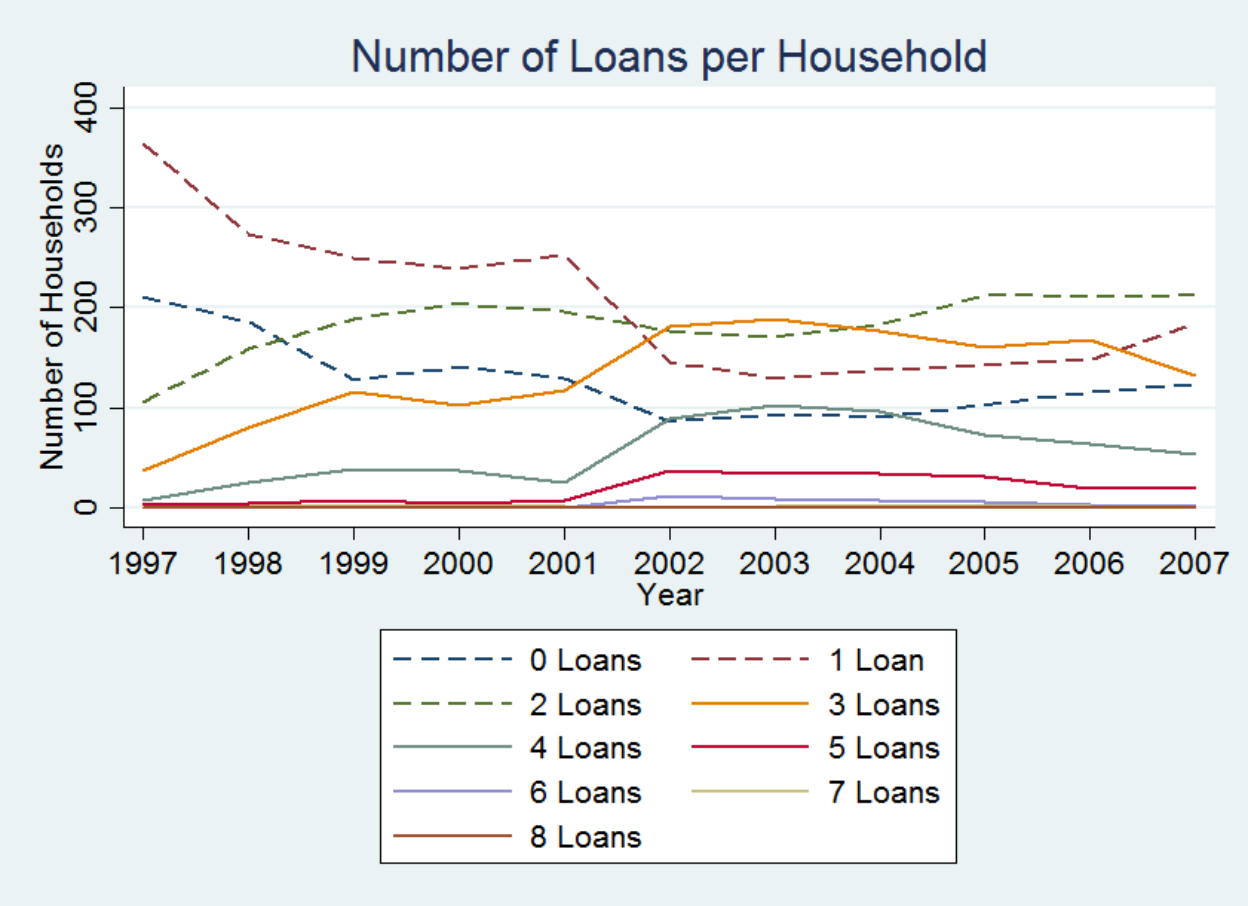
Number of Households Receiving Each Loan Type by Year

Year	Village Fund	Neighbor	Relative	BAAC	PCG	Comm. Bank	Agr. Coop	Rice Bank	Moneylender	Store Owner	Supplier	Landlord	Purchaser	Other
1997	8	47	103	249	6	28	86	6	83	28	2	3	15	73
1998	5	84	185	242	8	20	98	11	100	66	43	2	12	89
1999	10	92	250	276	11	28	111	9	138	71	34	2	14	128
2000	11	66	239	282	11	25	109	4	133	55	29	1	10	161
2001	8	38	217	289	25	24	106	13	131	49	26	0	15	201
2002	448	37	188	289	43	22	105	7	117	55	16	0	15	325
2003	504	27	155	293	51	19	94	4	103	63	14	0	13	342
2004	490	25	121	293	62	14	103	4	93	85	10	0	15	339
2005	491	24	89	288	69	12	115	11	63	59	5	1	12	304
2006	490	21	51	302	78	12	92	7	45	73	8	0	1	270
2007	470	19	36	299	66	10	91	5	30	45	7	0	8	255

Figure 7 shows the number of households that only have zero, one or two loans decreases dramatically. The number of households that have three or more loans increases. This change occurs between 2001 and 2002. The same years the Village Fund

was introduced, suggesting households took on more loans after the introduction of the Village Fund. These outcomes imply the Village Fund had a significant impact on village borrowing.

Figure 7



My dependent variable is the number of children aged 0 to 2 in a household. This variable tracks new births in a household. Most fertility studies use individual fertility data and have data on whether a particular woman conceived a child during a certain year (Lindo 2010). Household-level data is not as exact as individual-level data, but it will still reveal the impacts of the Village Fund on household fertility. For my right-hand side variables, I will be using information on household credit utilization, specifically how much was borrowed from the Village Fund, along with how much they borrowed from

other sources. Household characteristics such as, number of adult males (>15), number of children in age groups 2 to 15, number of women older than 15 and younger than 40, number of women over 40 years old, whether the head's primary occupation is farming, and net income are important right-hand side variables. For the purpose of this paper, I am defining women older than 15 and younger than 40 as women of childbearing age and women over the age of 40 as other women.

(1)

$$y_{i,t+1} = \beta_0 + \alpha VF_{i,t} + \beta_1 \sum_{k=1}^{13} H_{k,i,t} + \sum_{k=2}^{6} \beta_k X_{k,i,t} + \varphi_t + \varphi_i + \varepsilon_{i,t}$$

In Equation 1, $y_{i,t+1}$ is my left-hand side variable, number of children in household *i* in year *t+1*. $VF_{i,t}$ is the amount household *i* borrowed from the Village Fund in year *t*. $X_{k,i,t}$ is a vector of the *k* household characteristics and $\Sigma H_{k,i,t}$ is a sum of household borrowing other than the Village Fund.

Table 2

Variable Description	
LHS Variable Name	***Variable Label***
Villagefund	*Amount borrowed from Village Fund in 10,000 baht*
Otherloans	*Amount borrowed from other loan sources in 10,000 baht*
Netincome	*Net income in 10,000 baht*
Yngchild	*Number of children under 2 years old*
Otherchild	*Number of other children age 2 to 15*
Women_fert	*Number of women >15 and <40 years old*
Women_nonfert	*Number of women >40 years old*
Adultmale	*Number of males >15 years old*
Headfarm	*Dummy for farmer head of household*

Theory from existing literature helped me choose which variables to include in my model. The number of adult males and women of childbearing age is apparent. If there are more people in a household capable of reproducing then they will be more babies. The number of older children is also important because the number of existing children in a household might impact a household's decision to have an additional child. By including other women, I am hoping to capture any possible effects grandparents or other potential caregivers might have. My hypothesis is that a household with more women over 40 could have more babies because these other women in the household might be able to take some of the burden of childcare. Childcare help might influence a household's decision making. Whether the head of the household is a farmer or not is included in many similar studies (Kaboski and Townsend 2012) because farming families

might have different child preferences from non-farming families. Table 3 shows descriptive statistics of the key variables.

Table 3

Summary Statistics: Key Variables

	Mean	Std Dev	Min	Max	Count
Babies	0.11	0.32	0.00	3.00	7280
Net Income	10.50	20.02	-85.40	626.80	7280
Other Loan Sources	9.34	21.18	0.00	523.20	7280
Village Fund	0.95	1.71	0.00	26.00	7280
Farmer Head	0.51	0.50	0.00	1.00	7280
Other Children	1.20	1.09	0.00	7.00	7280
Women >40	0.91	0.52	0.00	3.00	7280
Women <40 (>15)	0.76	0.73	0.00	5.00	7280
Adult Males	1.54	0.93	0.00	8.00	7280

Note. N= 7280 households.

In Table 3 and Table 5 the net income, other loan sources and Village Fund variables are measured in 10,000 Thai baht. For the time period, 40 baht was about 1 US dollar. So, the mean net income was about $2,600 (US dollars). Farmer head is a dummy variable that indicates whether the head's primary occupation was farming. This is an important household characteristic to include. Theoretically, households that farm might make different child-bearing decisions than households that do not farm. A farming household might choose to have more children so they can have extra help with farming duties.

The household credit utilization variables will also be important for my analysis. There are many different borrowing sources in the data, but for my analysis I grouped them into Village Fund and Other Loan Sources. The Village Fund is the main variable I am interested in; therefore, I decided to group the others together. Although they are

grouped together, it is important to understand what other borrowing sources are available. The largest lending source is the Bank for Agriculture and Agricultural Co-operatives (BAAC), which is a government-owned bank that provides affordable credit for agricultural producers. One of the smaller sources, the Production Credit Group (PGC), is a community-level organization that helps promote good saving habits and issues small loans to the local community. My study focuses on money borrowed from the Village Fund, and including all of the sources a person borrows from is important because the amount they borrow from one source might impact the amount they borrow from another.

Table 4

Summary Statistics- Borrowing Characteristics

	Mean	Std Dev	Min	Max
Village Fund	9,523.49	17,141.42	0	260,000
BAAC	34,909.68	84,363.60	0	1,360,000
Neighbor	1,395.95	10,018.84	0	245,000
Relative	7,554.43	36,326.86	0	870,000
PCG	544.37	5,195.58	0	300,000
Commercial Bank	6,451.92	64,790.74	0	3,000,000
Agricultural Coop	7,234.09	29,122.97	0	1,000,000
Rice Bank	31.91	712.99	0	40,000
Money Lender	6,132.79	31,574.72	0	880,000
Store Owner	7,439.36	59,149.36	0	2,112,000
Supplier	2,250.89	59,042.28	0	4,700,000
Landlord	56.76	2,125.26	0	100,000
Purchaser	2,434.29	34,575.82	0	1,100,000
Other	16,944.19	107,877.14	0	4,600,000

Notes. The loan amounts are measure in 1 baht. N= 7280 households

Due to the way the data was collected, I can only look at it at the household level when looking at fertility. To be able to work with the data, I had to collapse the data to the household level. So, the borrowing variables will tell me how much a household

borrowed from a loan source, but not which member borrowed the money. This is an unfortunate but necessary loss of data.

Table 5 and Table 6 display the summary statistics of Village Fund borrowers and non-Village Fund borrowers. Some variable means are very similar: babies, women of childbearing age, adult males, other children. The means with the biggest difference are net income and other funds. The mean net income for Village Fund borrowers was 11.57 (in 10,000 baht) and 9.95 (in 10,000 baht) for non-Village Fund borrowers. This shows that households that borrowed from the Village Fund, on average, had 16,200 more baht in net income ($405 US). The amount borrowed from other funds was also substantially larger for Village Fund borrowers. On average, households that borrowed from the Village Fund borrowed 53,100 more baht ($1,327 US) than households that did not borrow from the Village Fund. This difference supports the idea that households that borrow from other sources are more likely to also borrow from the Village Fund. There are 421 households that only borrowed from the Village Fund.

Table 5

Summary Statistics: Village Fund Borrowers

	Mean	Std Dev	Min	Max
Babies	0.11	0.32	0.00	2.00
Net Income	11.57	18.36	-41.67	354.74
Other Funds	12.85	26.99	0.00	523.20
Village Fund	2.81	1.86	0.05	26.00
Farmer Head	0.56	0.50	0.00	1.00
Other Children	1.21	1.08	0.00	6.00
Women >40	0.97	0.50	0.00	3.00
Women <40 (>15)	0.72	0.72	0.00	4.00
Adult Males	1.55	0.84	0.00	6.00

Note. Net income, other funds and Village Fund measured in 10,000 baht. N= 2495

Table 6

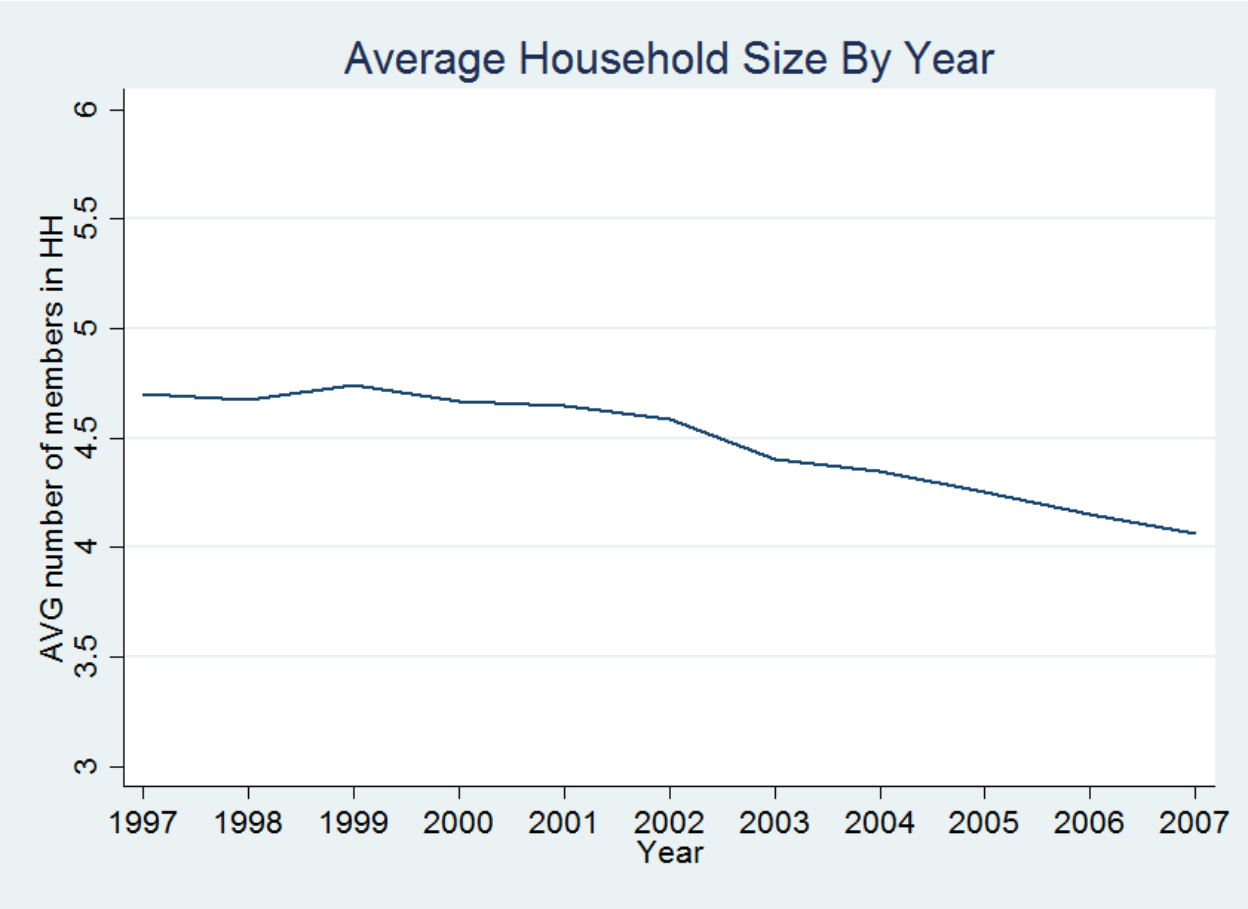
Summary Statistics: Not Village Fund Borrowers

	Mean	Std Dev	Min	Max
Babies	0.11	0.33	0.00	3.00
Net Income	9.95	20.80	-85.40	626.80
Other Funds	7.54	17.20	0.00	316.20
Village Fund	0.00	0.00	0.00	0.00
Farmer Head	0.49	0.50	0.00	1.00
Other Children	1.19	1.09	0.00	7.00
Women >40	0.88	0.52	0.00	3.00
Women <40 (>15)	0.79	0.74	0.00	5.00
Adult Males	1.54	0.97	0.00	8.00

Note. Net income, other funds and Village Fund measured in 10,000 baht. N= 4815

The other data I will use comes from a survey of village leaders. The important variable I will include from this dataset is the number of households in each village for a year. The mean number of households in a village is 170 with a standard deviation of 300 households. This variable will be crucial for my instrumental variable technique.

Figure 8



A quick look into the data shows that the average size of a household is changing. In Figure 8, it is evident that around 2000-2001, households started to get smaller. Using the available data, I should be able to determine if this decrease is due to reduced fertility, and whether this reduction in household size is a result of the sudden increase in available credit. When attempting to identify causation, it is important to be aware of the possibility of spurious results. A spurious relationship exists if available credit and household size appear to have a linear correlation, but there is a lurking variable that causes the two to decline and appear as if correlated.

Figure 9

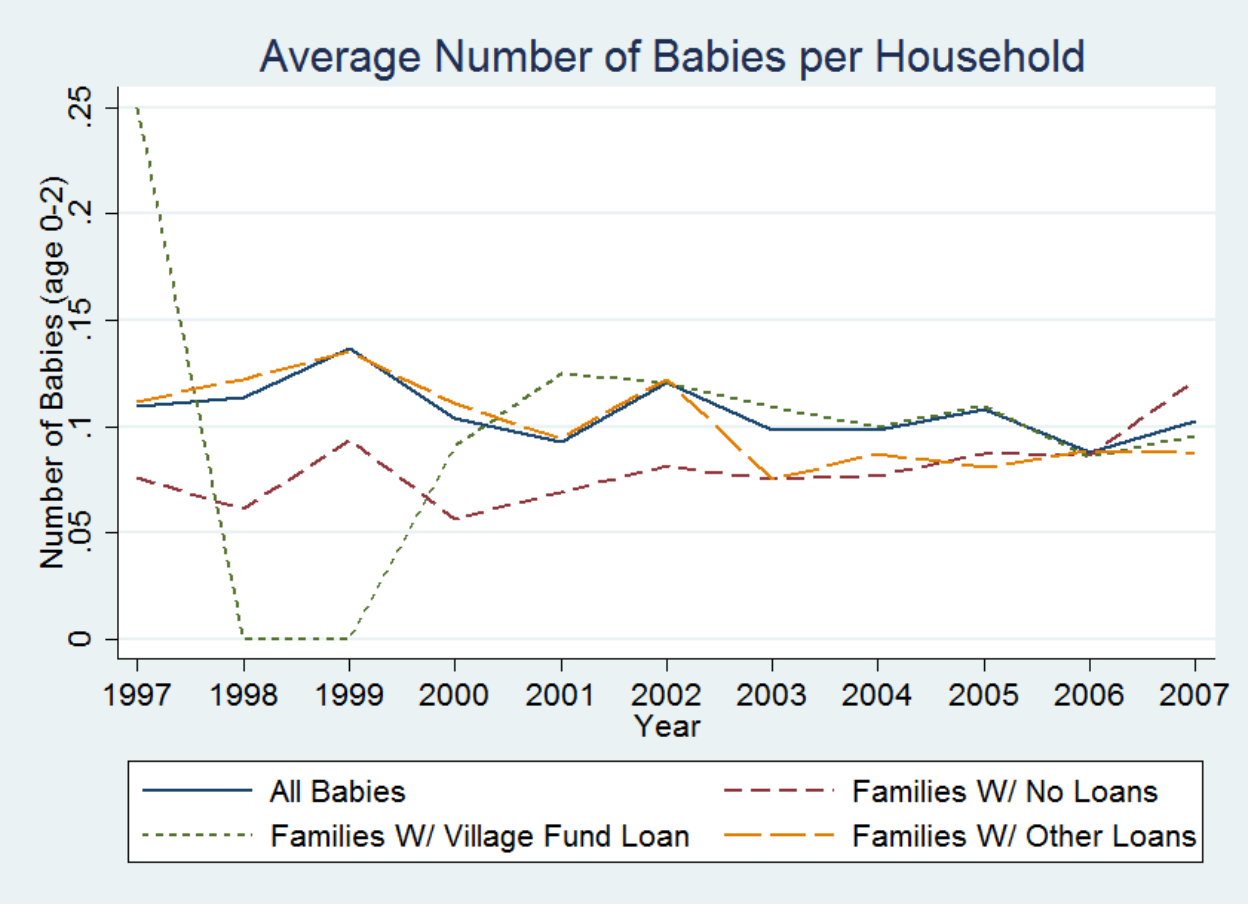


Figure 9 shows families with a Village Fund loan on average have more babies than households with no loans or loans from other sources. However, other factors are not controlled for, so there might be other aspects influencing these results. All of the lines converge around 2006.

5 Methods

My methodological approach is taken from Kaboski and Townsend (2012), which is the leading paper on the impacts of the Thai Million Baht Village Fund. A researcher should use fixed-effects models to control for variation and some aspects of self-

selection. This model controls for unobserved heterogeneity that is constant across time by using differencing, for example taking a first difference, which will remove time-invariant components of the model. In this case, there are many household characteristics that will also impact a household's specific fertility decisions. The Hausman test, confirmed a fixed-effects model is the appropriate model to use rather than a random-effects model (X^2= 74.63, p< 0.001). Some advantages of a random-effects model are more degrees of freedom and you can estimate coefficients for explanatory variables that are constant over time, but in this instance, a random-effects model was not valid.

Using time-specific and household-specific fixed-effects models I can eliminate unobserved variables that do not vary over time. Assuming fertility changes over time, which initial results support, this should be an appropriate method. As in Kaboski and Townsend (2012), Equation (2) is the specification for the impact of Village Fund credit ($VF_{i,t}$) of household *i* at time *t* on the outcome measure for fertility, $y_{i,t+1}$.

(2)

$$y_{i,t+1} = \beta_0 + \alpha VF_{i,t} + \beta_1 \sum_{k=1}^{13} H_{k,i,t} + \sum_{k=2}^{6} \beta_k X_{k,i,t} + \varphi_t + \varphi_i + \varepsilon_{i,t}$$

$VF_{i,t}$ measures how much household *i* borrowed from the Village Fund during year *t*. *X* is a set of six household characteristics control variables. *H* is total borrowing from 13 other funds. There are also the time-specific fixed-effects (φ_t) and a household-specific fixed-effect (φ_i). I chose to lead the dependent variable because it will take a minimum of nine months to observe a child in the dataset. Assuming a child is the result of a loan,

the loan occurs in year 1 while the child appears in year 2. Kaboski and Townsend (2012) run multiple regressions, some with the lagged value of the Village Fund credit and others using the current Village Fund credit. Because they are looking at consumption and income, they do not have this biological nine-month delay to account for.

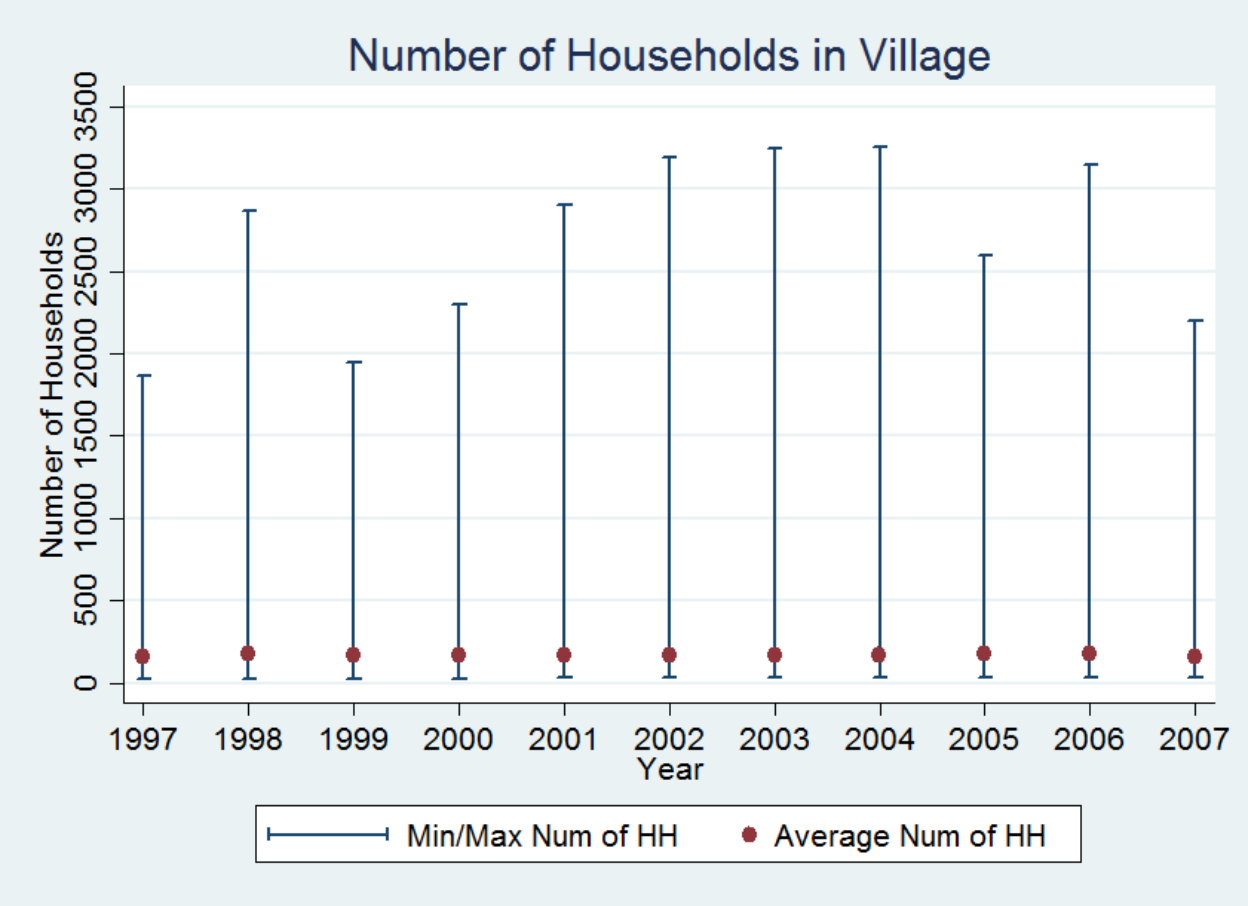
5.1 Instrumental Variable

Researchers use instrumental variables to solve the problem of endogenous regressors, when explanatory variables are correlated with the error term. In this situation, OLS will provide inconsistent estimators. Instrumental variables provide a way to obtain consistent parameter estimates. This instrumental technique was used by Kaboski and Townsend (2012). The instrument is the interaction of the inverse number of households in the village and the post-program year dummies. Kaboski and Townsend (2012) argue that program year and the number of households in a village are exogenous. The number of households in a village is not connected to the number of babies, but the number of households in a village will be connected to the amount of credit available to each household in the Village Fund. The researchers restrict their research to villages with 50 to 250 households and argue that the most important variation comes from these small villages, but they also find their results are robust to including larger or smaller villages. They find that the microfinance injections averaged 27 percent of income in the smallest villages and less than 2.5 percent in the largest villages (Kaboski and Townsend 2012). The researchers do not clarify why they restricted their research to these sizes, which excluded 9 of the 64 villages in the survey. In 2002, the number of households in the excluded villages were: 30, 34, 268, 297, 305, 314, 400, 900 and 3194. Because

Kaboski and Towsend's (2012) results were robust to including all the villages I am using all the available villages.

The instrumental variable of inverse village size affects the Village Fund credit because it changes how much credit a household has access to. The instrumental variable is necessary because the Village Fund was not randomly assigned or distributed. But, the number of households in a village should not have an independent effect on individual household fertility. If my assumptions are correct, this is a valid instrumental variable.

Figure 10



Kaboski and Townsend (2012) use a two-stage least squares approach. By using the interaction between the inverse number of households in the village and a dummy of post-program year, it controls for variations across households correlated with the inverse of village size and uses the additional effect of inverse number of households as the instrument (Townsend and Kaboski 2012). One potential problem is that the number of young children in a household might be correlated with the instrumental variable. The reason I see a potential issue is that if a household has a child and then that might cause part of the household to break off and form a new household. I anticipate the potential increase in the number of households in a village due to having a child is minimal and does not have a substantial impact on the validity of my instrumental variable. Figure 10 shows that there are not any significant changes in the average number of households in a village. Since it stays fairly constant, I assume that this will not impact my instrumental variable. This instrumental variable technique combined with the quasi-experimental nature of the Thai Million Baht Village Fund and a panel dataset will allow me to make a new contribution to the existing literature.

6 Results

This section discusses estimation results for the impact of a microfinance program on number of young children a household has. Table 7 present the results of the various models used for my estimation process with the IV model in column 3 being the most relevant results.

Table 7

Model Results

Dependent Variable = Babies	(1) OLS	(2) OLS FE	(3) IV FE
Village Fund	0.00013	-0.00238	-0.01605**
	[0.00334]	[0.00393]	[0.00764]
Net Income	-0.00003	0.00014	0.00018
	[0.00021]	[0.00054]	[0.00026]
Other Children	-0.012***	-0.064***	-0.064***
	[0.004]	[0.007]	[0.005]
Other Loan Sources	-0.00030*	0.00001	0.00006
	[0.00018]	[0.00022]	[0.00026]
Women >40	0.021**	0.017	0.020
	[0.009]	[0.015]	[0.014]
Women <40 (>15)	0.067***	0.040***	0.039***
	[0.007]	[0.011]	[0.008]
Farmer Head	0.008	-0.017	-0.017
	[0.010]	[0.013]	[0.011]
Adult Males	0.022***	0.015**	0.016**
	[0.005]	[0.007]	[0.007]
Constant	0.017	0.136***	0.131***
	[0.017]	[0.030]	[0.022]
Year Fixed Effects	Yes	Yes	Yes
Household Fixed Effect	No	Yes	Yes
Number obs.	7280	7280	7280
R^2	0.03	0.03	
Squared Correlation			0.201

Notes.Coefficients are reported with standard errors in brackets. ***, **, and * indicate significance at the 1%, 5%, and 10% levels. Variables net income, Village Fund and other loan sources are measured in 10,000 Baht. Robust standard errors clustered on village ID for model 1 and model 2. Squared correlation is the squared correlations between the left-hand side variable and predicted value.

Model 1 is a simple OLS regression. In the OLS regression the R^2 is 0.03 and Village Fund is not significant. Because there are certain characteristics about a household that makes them more or less likely to get a loan or have more children, an OLS regression will be affected by this omitted variable bias and have potential inconsistent results.

To address this issue, I need to use fixed or random effects. The Hausman test uses the differences in the coefficients of fixed effects and random effects model to decide if a random effects is the appropriate model to use. I reject the random effects specification (X^2 =26.08, p =0.037), so apply fixed effects. I added in household fixed effects in Model 2. Fixed effects control for these unseen household characteristics that do not change over time. The Village Fund coefficient is still insignificant, but now it is negative.

It is important to include household fixed effects, but this does not solve the endogeneity problem. There could be certain characteristics about a household that makes them more likely to participate in the Village Fund program. To correct for this, I use an instrumental variable, which helps give the Village Fund a degree of exogeneity. Model 3 is a combination of fixed effects and an instrumental variable. This model provides the most reliable results.

The first stage results (Table 8) are useful for determining whether instrumental variable approach is valid. The regression performs a weak identification test where the H_0 is the equation is weakly identified. With an F-statistic of 295.38 and a 5% relative bias critical value of 18.37, I can reject that the max bias in 5% due to a weak instrument. This means the maximum bias from a weak instrument is less than 5%.

Table 8

IV Regression --- First Stage

Village Fund	**Coef.**
IV 2002	72.474***
	[7.162]
IV 2003	146.399***
	[7.515]
IV 2004	169.490***
	[8.313]
IV 2005	204.990***
	[8.188]
IV 2006	197.542***
	[7.383]
Net Income	0.002***
	[0.0009]
Other Children	0.017
	[0.019]
Other Loan Sources	0.004***
	[0.0009]
Farmer Head	0.093**
	[0.037]
Women >40	0.224***
	[0.046]
Women <40 (>15)	0.011
	[0.026]
Adult Males	0.073**
	[0.022]
Year Dummies	YES
Cragg- Donald Wald F statistic	295.38
5% relative bias	18.37

Some of the results from Model 3 (Table 7) were unexpected. Contrary to what I expected, net income was not statistically significant. To interpret the variable, it is important to remember that it is measure in 10,000 baht. When changed into dollars, this result shows that for every 100,000,000 baht ($2.5 million US dollar equivalent) increase in net income, on average a family has 1.79 more children. This result is statistically and practically insignificant and it is pointless to make any inferences from this result as to children being a normal or inferior good.

Another result I found surprising was the farmer head coefficient. It is a dummy variable indicator for whether the head of the household was a farmer or rancher. Theoretically, I expected this result to be positive because the literature supports the idea that agricultural families tend to have more children than non-farming families. Along with the unexpected sign of this variable, it was also statistically insignificant. Being a farmer rather than non-farmer was associated with 0.017 fewer children, all else constant.

Some results met my expectations. The number of other children in the household aged 2 to 15 was significant to the 1 percent level. It was a count variable of the number of other children in the household, so holding all else constant, for every additional child in that age group, a household had 0.06 fewer babies, on average.

The number of women of childbearing age and adult males were both significant results. The number of women of childbearing age is a count variable of the number of women above the age of 15 and under 40 years old. Significant at the 1 percent level, for every additional woman of childbearing age in a household, the household had 0.039 more babies. I would have been concerned with the validity of my model if the result would have been negative and insignificant. If there are more women of childbearing age

in a household, I expect that household has more babies. Similarly, I expected a positive and significant result for the number of adult males in a household. For every additional adult male in a household, the household had .015 more children, on average (significant at the 5 percent level). Other women in a household had a positive but not statistically significant. An additional woman above 40 years of age in a household was associated with a 0.02 baby increase, all else constant.

The Village Fund variable was the main variable of interest. It negative and was significant to the 5 percent level. This variable is measured in 10,000 baht. For every additional 1,000,000 baht borrowed ($25,000 US dollar equivalent) a household had on average, an additional 1.60 new children. While this result is statistically significant, it is not practically significant because these loans are given in small amounts, typically under 20,000 baht ($500 US dollar equivalent). The other borrowing sources were not statistically or practically significant. I believe this is due to the grouping of the loans together. The BAAC is a substantial loan source and might have had significant impacts, but when included with insignificant borrowing sources like rice banks and landlords, the significance of the larger funds might have been overpowered by the insignificance of the other loan sources. I will test a model where BAAC is a separate variable in my robustness checks.

6.1 Robustness Check

Checking for robustness is an important way to examine core regression variables. In my analysis, the Village Fund variable is my key right-hand side variable and to check for robustness I modify my regression by including or excluding other variables.

In Table 9, the results for Model 1 show that the Village Fund coefficient is not significant. Poisson models are used when the dependent variable is a count and my dependent variable is a count of how many babies are in a household. While it was useful to run this regression and understand its benefits, it had one main weakness. With the instrumental variable Poisson model I could not include household fixed effects. Instead, I had to include regional-level fixed effects. Although, there might be reason to believe that there are certain characteristics about a region that should be fixed, the loss of the household-level fixed effects cannot be ignored. The coefficient is negative for all three models, but because we are losing household fixed effects in the Poisson model with an instrumental variable we are not efficiently estimating the coefficient. Model 2 (Table 9) excludes households that have a head who identifies their primary occupation to be farming. Model 3 keeps households only that have loans only from the Village Fund or no loans at all. About 420 of the 1605 observations had a Village Fund loan. Village Fund has a much larger constant in Model 2. When the sample was restricted to non-borrowers and Village Fund borrowers, participating in the Village Fund program had a larger impact on number of babies in a household.

Table 9

Robustness Checks

Dependent Variable = Babies	(1) IV Poisson	(2) No Farmers	(3) No Loans or only VF
Village Fund	-0.05553	-0.01688*	-0.08872**
	[0.06479]	[0.00926]	[0.04224]
Net Income	-0.00059	-0.00033	0.00022
	[0.00099]	[0.00032]	[0.00074]
Other Children	-0.113***	-0.05733***	-0.03730***
	[0.034]	[0.00811]	[0.01432]
Other Loan Sources	-0.003	-0.00020	
	[0.002]	[0.00045]	
Farmer Head	0.025		-0.01877
	[0.076]		[0.02461]
Women >40	0.141**	0.00574	0.01276
	[0.067]	[0.01845]	[0.03066]
Women > 40 (>15)	0.511***	0.04368***	0.07636***
	[0.037]	[0.01180]	[0.01895]
Adult Males	0.180***	0.01865*	0.02232
	[0.033]	[0.00994]	[0.01598]
Constant	-2.949***	0.10431***	-0.00009
	[0.176]	[0.03023]	[0.04664]
Region Fixed Effects	Yes	No	No
Year Fixed Effects	Yes	Yes	Yes
Household Fixed Effects	No	Yes	Yes
Number obs.	7280	3541	1605
Squared Correlation	0.026	0.297	0.357

Notes.Coefficients are reported with standard errors in brackets. ***, **, and * indicate significance at the 1%, 5%, and 10% levels. Variables net income, Village Fund and other loan sources are measured in 10,000 Baht. Model 2 drops out all households that have a head who is a farmer. Model 3 drops out all households that received loans from sources other than Village Fund. Squared correlation is the squared correlations between the left-hand side variable and predicted value.

Additional robustness checks confirm the approximate size and sign of the Village Fund (Table 10). Model 1 (Table 10) displays how the results change when limited to poor households (below the 25th percentile in net income). Model 2 (Table 10) drops households that do not have children aged 2 to 15. The rational for this model, is

the possibility that if households do not have other children, then they might not be able to conceive. Model 5 separated the BAAC from other loan sources. A significant proportion of loans come from the BAAC and it is useful to see its impacts. All the models have relatively similar coefficients. The sign on the Village Fund coefficient is the same and magnitude does not vary much.

Table 10

Robustness Checks 2

	(1) Low Net Income	(2) Only Households w/ Children	(3) BAAC Separate
Village Fund	-0.02249	-0.01493	-0.01601**
	[0.02415]	[0.01079]	[0.00763]
Net Income	-0.001	-0.0002	0.0002
	[0.004]	[0.0004]	[0.0003]
Other Children	-0.055***	-0.079***	-0.063***
	[0.011]	[0.008]	[0.006]
Other Loans (w/ BAAC)	0.0006	0.00002	
	[0.0008]	[0.00032]	
Women >40	-0.015	0.024	0.020
	[0.029]	[0.017]	[0.014]
Women <40 (>15)	0.004	0.019*	0.040***
	[0.017]	[0.010]	[0.008]
Adult Males	0.024	0.015*	0.016**
	[0.014]	[0.008]	[0.007]
Farmer Head	-0.004	-0.0004	-0.017
	[0.024]	[0.0138]	[0.011]
BAAC			0.00000004
			[0.00000008]
Other Loans (w/o BAAC)			0.000000002
			[0.000000028]
Constant	0.156***	0.227***	0.130***
	[0.045]	[0.029]	[0.022]
Household Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes
Number obs.	1906	5028	7280
Squared Correlation	0.383	0.234	0.201

Notes.Coefficients are reported with standard errors in brackets. ***, **, and * indicate significance at the 1%, 5%, and 10% levels. Variables netincome, villagefund and othermfp are measured in 10,000 Baht. Model 1 drops out households that had a net income above the 25th percentile (31,500 baht). Model 2 only keeps households that had at least one child aged 2 to 15. Model 3 separated out BAAC from other loan sources. Squared correlation is the squared correlations between the left-hand side variable and predicted value.

7 Conclusion

The goal of this research was to identify how a microloan program impacted household fertility decisions in Thailand. The empirical evidence suggests that getting a microloan from the Thai Million Baht Village Fund had a negative impact on the number of babies a household had. Although the result was statistically significant, a family would have to borrow 1 million baht for the funds to result in 1.60 fewer babies. This amount is far beyond what anyone could borrow and is therefore of practical insignificance.

This result is important in the case of Thailand because of their unusually low fertility rates. My results showed a miniscule impact in the number of babies in a household after they borrowed from the Village Fund. The policy implications of this suggest that using microfinance programs as a development tool in Thailand is a beneficial use of development spending because it does not have a significant adverse effect on the country's fertility rates. If the results were practically significant, this would suggest that Thailand would have to consider using other development tools that were not going to decrease fertility rates even further, or coupling a microfinance program with additional programs, like a childcare subsidy. This would lower the opportunity costs for women of having a child.

It is important to note that the small effects of the microfinance program on fertility might be due to the pre-existing trend of low fertility in Thailand. The fertility rates in Thailand are 1.5 births per woman. This is very low relative to other countries with only 27 countries having a lower fertility rate.[11] There is a possibility that the

[11] https://www.cia.gov/library/publications/the-world-factbook/rankorder/2127rank.html

fertility rate cannot easily drop much below 1.5 births per woman and that is why I do not see a significant impact of the microfinance program.

The impacts of microfinance on fertility are not typical areas of study. Most literature focused on the changes in GDP, consumption and expenditure. There are substantial issues associated with below replacement fertility. It results in labor shortages and can have detrimental impacts on the economy. It was important to make sure that the unintended negative impacts of the microfinance program on household fertility did not outweigh the positive impacts on GDP and consumption.

There are a few potential issues to consider for the validity of this study. Attrition is a serious issue if certain types of households were leaving the survey. For further research, I would study the characteristics of these households to make sure there is not any reason to believe their exit from the survey is impacting my results. Omitted variable bias could also be having a harmful impact on my results. While it is nearly impossible to correctly specify this type of model without some amount of omitted variable bias, including more variables about household characteristics and village characteristics might better identify the impact of the Village Fund on household fertility.

Along with correctly identifying the influential variables in a model, correctly specifying the time frame can be a challenge. There is potential that the number of lags I used was incorrect. I assumed the impacts of getting a loan would show up in the next year's data because most studies of income shocks and fertility look at the fertility choices for the next year (Lindo 2010). Under my assumption, any fertility decisions that are caused by a household getting a loan will happen within a few months of the loan and then nine months later they have an additional child. Surveys were given annually in

May. Based on when a household gets a loan in the survey cycle, a baby could show up in the next year's survey or it might take two years for the survey to capture the extra child. It is possible that it would take longer for a microloan to impact fertility decisions and a two or three year lag would be more appropriate. To address this issue, in addition to leading my dependent variable, I included children ages 0 to 2 with the hopes that this will solve for any timing issues.

One weakness of my research is the absence of specific fertility data. To complete my research, I made certain assumptions to validate my dependent variable. One assumption is that a child aged 0 to 2 is a child conceived by someone who also lives in the same household. If I had individual-level fertility data, I could more accurately identify the causal relationship between receiving a microloan and having a child.

The last issue is the access versus participation distinction that Buttenheim (2006) and Sukontamarn (2006) discuss. If it truly is the access to a microfinance program that results in changes to fertility decisions rather than actual participation, my results could be incorrect. Every village in my sample has the Village Fund program, so any changes due to solely having the program in the village would not be observable with the data I used. For further research, it would be useful to find a data set that has villages with and without the program and use villages without the program as a control.

Using an 11-year panel dataset from Thailand spanning pre and post-program years, I assess how the Thai Million Baht Village Fund program influenced household fertility. With a fixed-effects model and an instrumental variable technique I analyze the changes in the number of new children in a household.

Despite the aforementioned caveats, I find a negative impact of getting a Village Fund microloan on fertility that is statistically significant but not practically significant. This negative relationship supports much of the existing literature. This research is especially important for Thailand because of their dangerously low fertility rates. My findings do not suggest any immediate policy adjustments, but rather, rule out a potential negative unintended consequence of microfinance in Thailand.

References

Ahlin, Christian and Neville Jiang. 2008. "Can Micro-Credit Bring Development?" *Journal of Development Economics* 86 (1): 1-21.

Amin, Ruhul, Robert B. Hill, and Yiping Li. 1995. "Poor Women's Participation in Credit-Based Self-Employment: The Impact on their Empowerment, Fertility, Contraceptive use, and Fertility Desire in Rural Bangladesh." *Pakistan Development Review* 34 (2): 93-119.

Banerjee, Abhijit, Esther Duflo, Rachel Glennerster, and Cynthia Kinnan. 2015. "The Miracle of Microfinance? Evidence from a Randomized Evaluation." *American Economic Journal: Applied Economics* 7 (1): 22-53.

Boonperm, Jirawan, Jonathan Haughton, and Shahidur R. Khandker. 2013. "Does the Village Fund Matter in Thailand? Evaluating the Impact on Incomes and Spending." *Journal of Asian Economics* 25: 3-16.

Buttenheim, Alison M. 2006. "Microfinance Programs and Contraceptive use: Evidence from Indonesia." *California Center for Population Research*. Working Paper.

Crepon, Bruno, Florencia Devoto, Esther Duflo, and William Pariente. 2015. "Estimating the Impact of Microcredit on those Who Take it Up: Evidence from a Randomized Experiment in Morocco." *American Economic Journal: Applied Economics* 7 (1): 123-150. doi://dx.doi.org/10.1257/app.7.1.123.

De La Huerta Barradas, Adriana B. (Ph D). 2011. "Microfinance in Rural and Urban Thailand: Policies, Social Ties and Successful Performance." University of Chicago.

Desai, Jaikishan, Alessandro Tarozzi, and Kristin Johnson. 2015. "The Impacts of Microcredit: Evidence from Ethiopia." American Economic Journal: Applied Economics 7 (1): 54-89.

Gaonkar, Rekha Ramesh and Elizabeth Joey Henriques. 2011. "Micro-Credit: A Study of Micro-Credit Usage by Self Help Group Members in Goa." *International Journal of Research in Commerce, Economics and Management* 1 (3): 56-60.

Gruber, Jonathan, Nathaniel Hendren, and Robert M. Townsend. 2014. "The Great Equalizer: Health Care Access and Infant Mortality in Thailand." *American Economic Journal: Applied Economics* 6 (1): 91-107.

Hermes, Niels and Robert Lensink. 2007. "The Empirics of Microfinance: What do we Know?" *The Economic Journal* 117 (517): F10.

Kaboski, Joesph P. and Robert M. Townsend. 2011. "A Structural Evaluation of Large-Scale Quasi-Experimental Microfinance Initiative." *Econometrica* 79 (5): 1357-1406.

Kaboski, Joseph P. and Robert M. Townsend. 2012. "The Impact of Credit on Village Economies." *American Economic Journal: Applied Economics* 4 (2): 98-133.

Khandker, Shahidur R. and Mark M. Pitt . 1998. "The Impact of Group-Based Credit Programs on Poor Households in Bangladesh: Does the Gender of Participants Matter?" *Journal of Political Economy* 106 (5): 958-996.

Khandker, Shahidur R. 1998. *Fighting Poverty with Microcredit : Experience in Bangladesh / Shahidur R. Khandker.* Oxford University Press.

Khandker, Shahidur R. 2005. "Microfinance and Poverty: Evidence using Panel Data from Bangladesh." *The World Bank Economic Review* 19 (2): 263-286.

Kim, Jungho. 2010. "Women's Education and Fertility: An Analysis of the Relationship between Education and Birth Spacing in Indonesia." *Economic Development and Cultural Change* 58 (4): 739-774.

Kuchler, Andreas. 2012. "Do Microfinance Programs Change Fertility? Evidence using Panel Data from Bangladesh." *Journal of Developing Areas* 46 (2): 297-313.

Levy, Victor. 1985. "Cropping Pattern, Mechanization, Child Labor, and Fertility Behavior in a Farming Economy: Rural Egypt." *Economic Development and Cultural Change* 33 (4): 777-791.

Lindo, Jason M. 2010. "Are Children really Inferior Goods? Evidence from Displacement-Driven Income Shocks." *Journal of Human Resources* 45 (2): 301-327.

Long, Bridget Terry and Una Okonkwo Osili. 2008. "Does Female Schooling Reduce Fertility? Evidence from Nigeria." *Journal of Development Economics* 87 (1): 57-75.

Mithranon , Preeya and Vipan Prachuabmoh. 2003. "Below-Replacement Fertility in Thailand and its Policy Implications." *Journal of Population Research; Dordrecht* 20 (1): 35-50.

Pitt, Mark M. 1999. "Credit Programs for the Poor and Reproductive Behavior in Low-Income Countries: Are the Reported Causal Relationships the Result of Heterogeneity Bias?" *Demography* 36 (1): 1-21.

Sukontamarn, P. 2006. "Micro-Credit, Fertility Decisions, and Women's Empowerment in Bangladesh." Unpublished Working Paper.

Tedeschi, Gwendolyn Alexander. 2008. "Overcoming Selection Bias in Microcredit Impact Assessments: A Case Study in Peru." *Journal of Development Studies* 44 (4): 504-518.